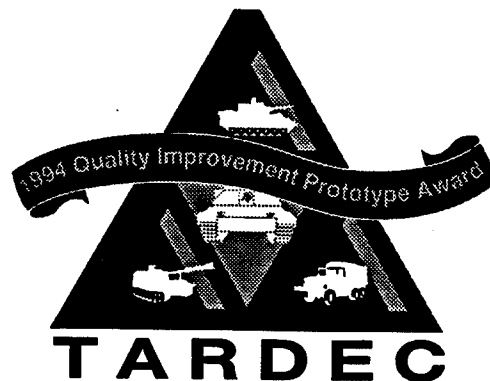


# TARDEC

---TECHNICAL REPORT---

THE NATION'S LABORATORY FOR ADVANCED AUTOMOTIVE TECHNOLOGY

No. 13660



RIDE MOTION SIMULATOR (RMS) TESTING  
USING HUMAN OCCUPANTS  
(Submitted to Human Use Committee)  
FINAL REPORT

DECEMBER 1994



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U.S. Army Tank-automotive and  
Armaments Command  
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## PREFACE

This report discusses the use of human occupants in the Ride Motion Simulator (RMS). Questions regarding ride motion simulation of vehicles using the Ride Motion Simulator are to be referred to the U.S. Army Tank-Automotive Research, Development and Engineering Center, ATTN: Simulation, Test and Reliability Group, AMSTA-TR-X, Warren, MI 48397-5000, Telephone: AUTOVON/DSN 786-6228, Commercial (810) 574-6228, FAX (810) 574-8667.

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## 1.0 INTRODUCTION

The U.S. Army Tank-automotive and Armaments Command (TACOM) has full safety certification from the U.S. Army Test-Evaluation Command (TECOM) for the Ride Motion Simulator (RMS). This certification allows the use of test subjects in the seat of the RMS during its operation. The Crewmans Associate Job was performed on 17 October - 4 November 1994. Human test subjects were used to test and evaluate using various combinations of two different driving controllers and two different helmet mounted displays (HMD) while under terrain-type and sine wave motion conditions.

Prior to conducting a simulation using test subjects, approval for the test plan was obtained from the Human Use Committee (HUC) and the commander of the Tank-Automotive Research Development and Engineering Center (TARDEC). A Volunteer Agreement Affidavit, form DA 5303-R, is completed for each subject. The test was then conducted and this report, summarizing the test results, is being submitted to the HUC to finalize the test.

## 2.0 OBJECTIVE

The objective of this report is to summarize the results of using human occupants in the RMS during the Crewmans Associate Job. This report does not address the subjective data obtained on the helmet mounted displays and controllers preferability and usability. This report will be submitted to the Human Use Committee and describes the tests conducted.

## 3.0 CONCLUSION

The tests were completed without incident to any of the test subjects. The use of human occupants provided invaluable test data since the results of the experiment should provide justification for both near and far-term crewstation design decisions.

## 4.0 RECOMMENDATIONS

This test again shows that the RMS is safe for human use. The large amount of hardware/software interlocks and numerous safety precautions taken by Physical Simulation Laboratory (PSL) personnel before and during operation, make the simulator very safe. The simulator is an excellent tool for a wide variety of testing including controller/HMD combinations, man/machine interaction, etc.

## 5.0 DISCUSSION

All test runs are listed below.

### 10/17/94 - 10/28/94

Test Subjects: Soldiers (5) from Ft. Knox, Kentucky.

Test Protocol: Small periods of sinusoidal motion and simulated terrain motions of a Bradley traversing Perryman1 (@25mph), Perryman2 (@15mph), and Churchville B(@10mph) were performed.

Comments: All tests ran smoothly. Each test run lasted approximately 30 minutes and consisted of 9 different sinusoidal motions and 3 different terrains. The testing period went from 0800 hrs to 1600 hrs, 2 runs for each soldier making it a total of ten runs a day.

### 10/31/94 - 11/4/94

Test Subjects: Civilians (8) from the Crewmans Associate TEAM (TARDEC).

Test Protocol: Small periods of sinusoidal motion and simulated terrain motions of a Bradley traversing Perryman1 (@25mph), Perryman2 (@15mph), and Churchville B(@10mph) were performed.

Comments: All tests ran smoothly. Each test run lasted approximately 30 minutes. The testing period lasted all day (0800-1400), with each subject only riding a total of 4 times during the entire week.

Appendix A contains position and acceleration plots of the dynamic scenarios used. There was a maximum of  $\pm 2$  g's of acceleration during the test scenarios as shown in the acceleration plots in the appendix. In summary, no problems were incurred during any of the testing. The test subjects reported no ill effects from the runs.

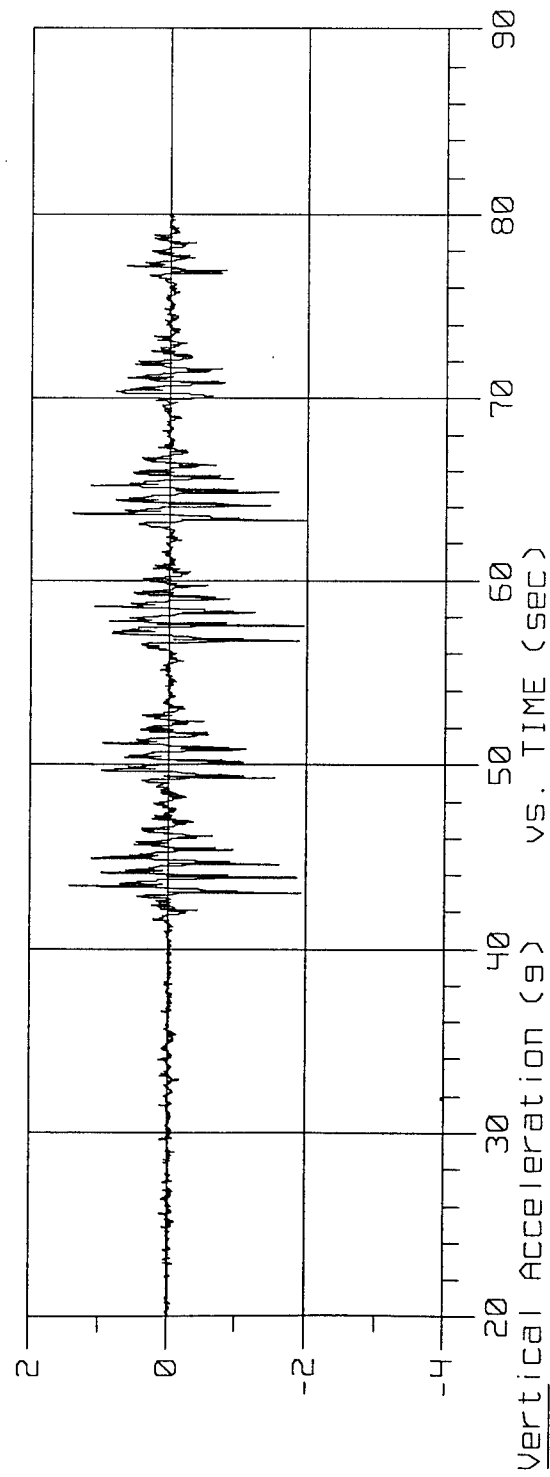
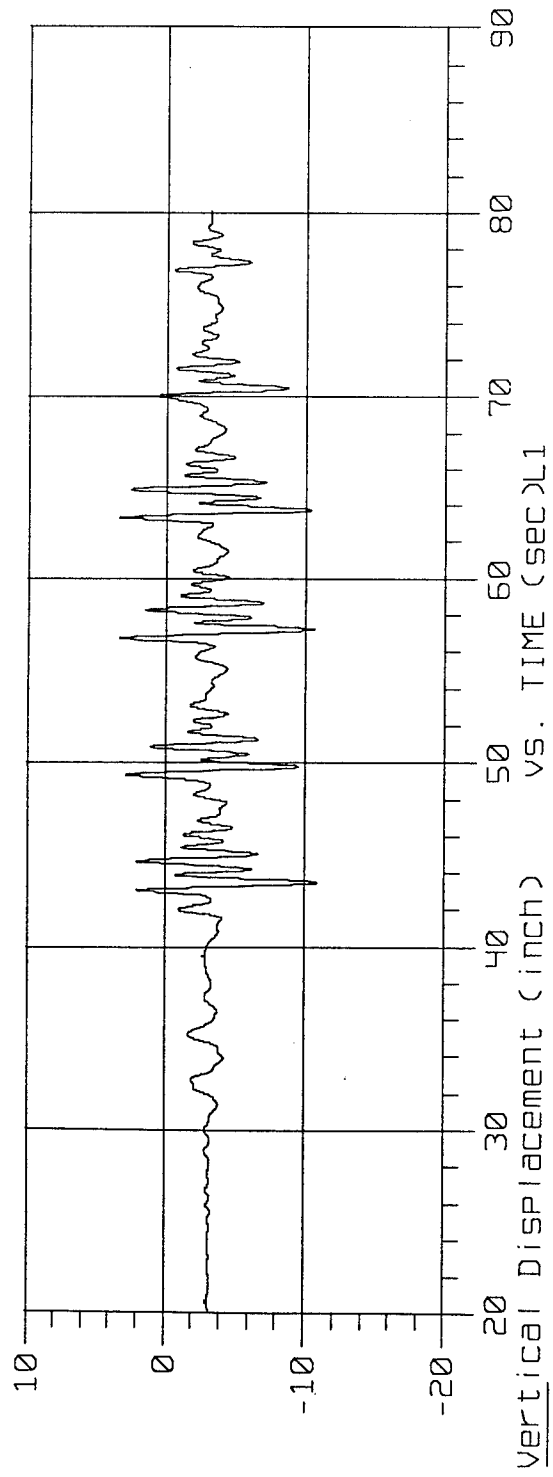


## APPENDIX A

### Position and Vertical Acceleration Plots

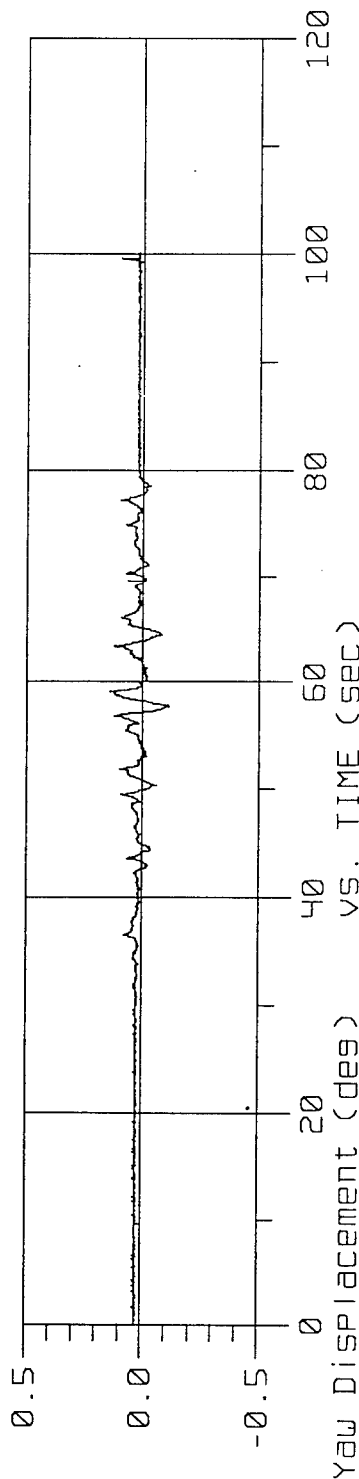
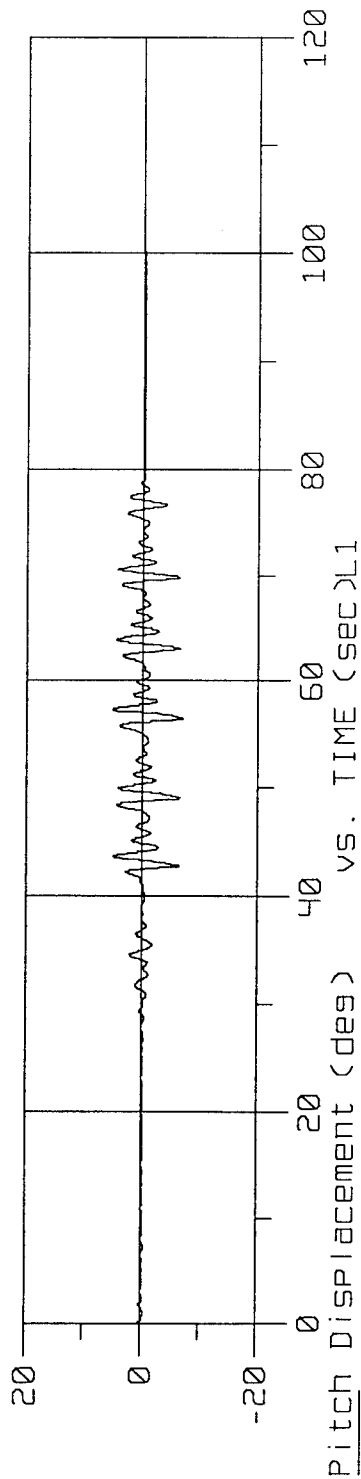
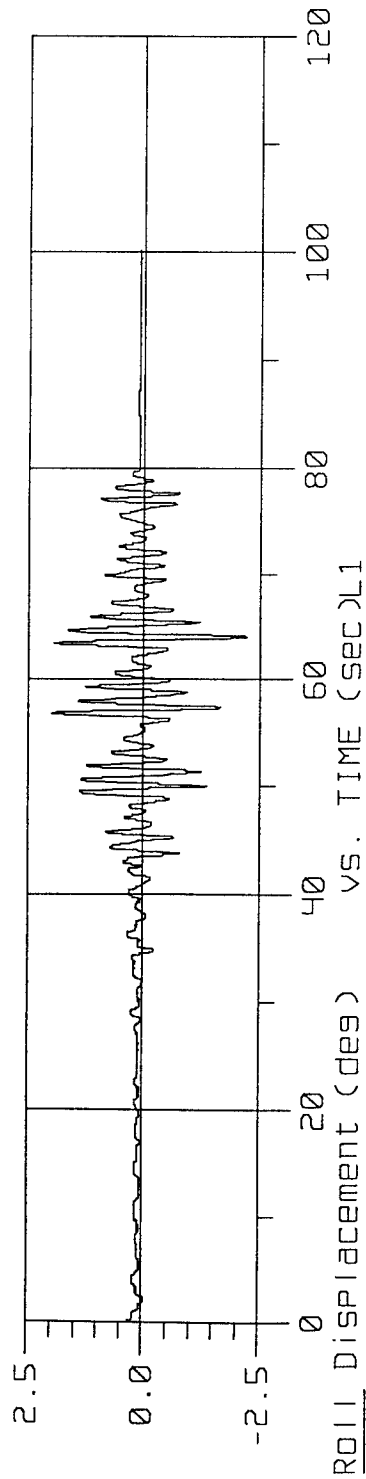
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Measured data for Churchill B @ 10mph



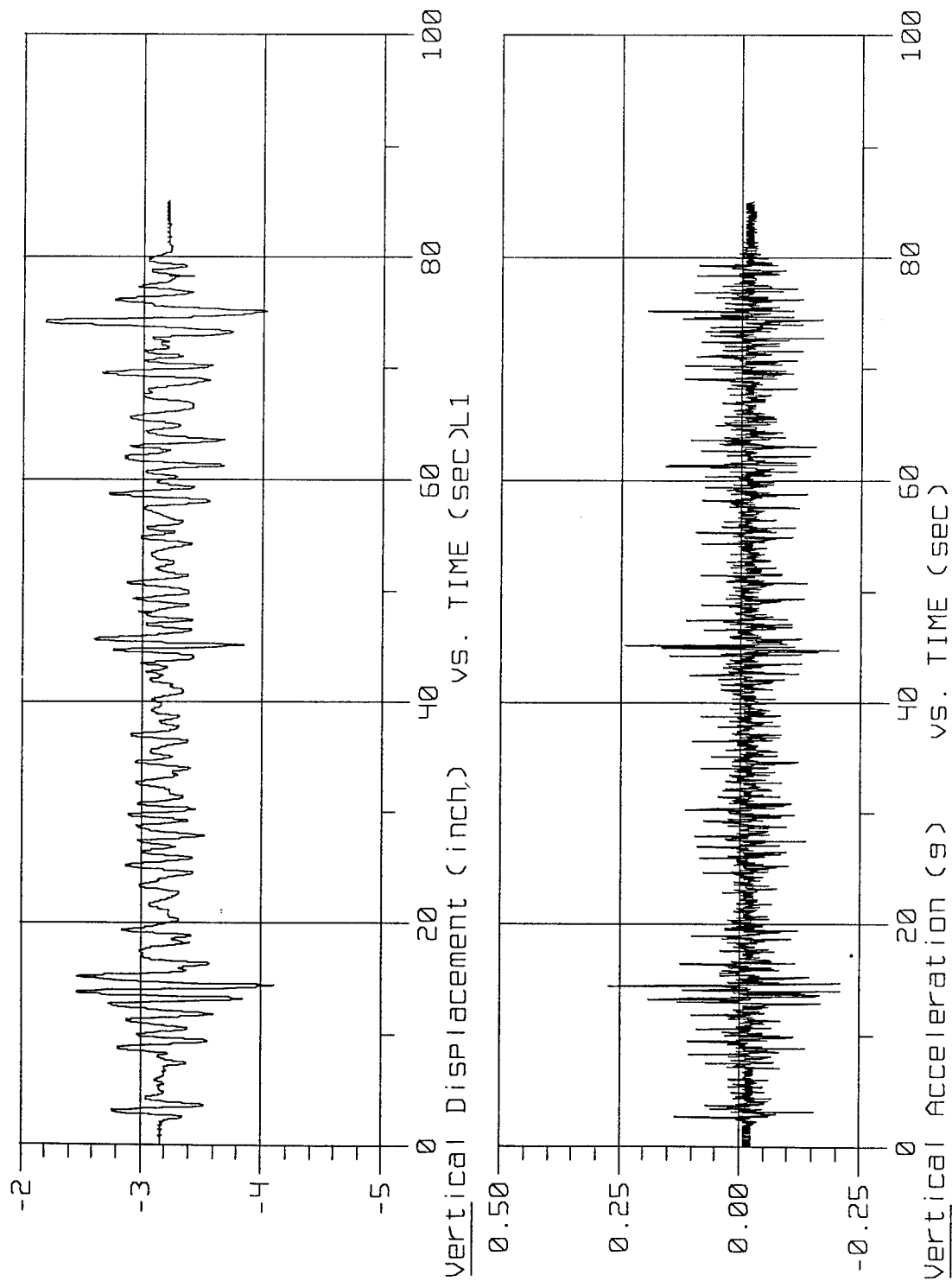
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Measured data for Churchville B @ 10mph



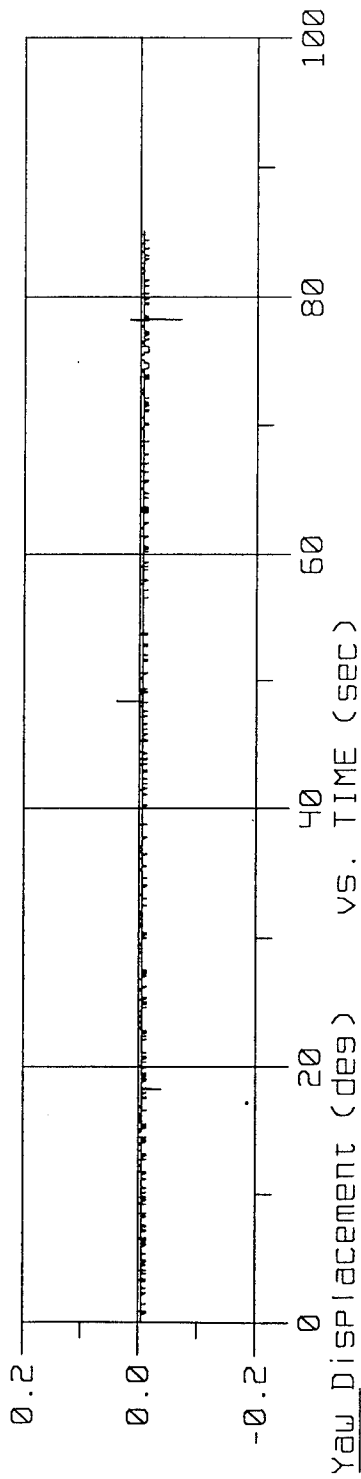
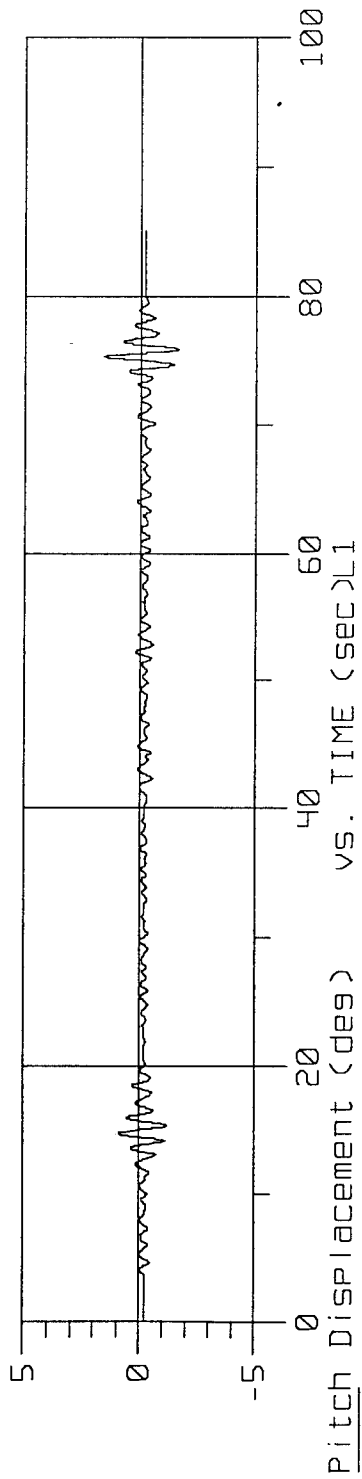
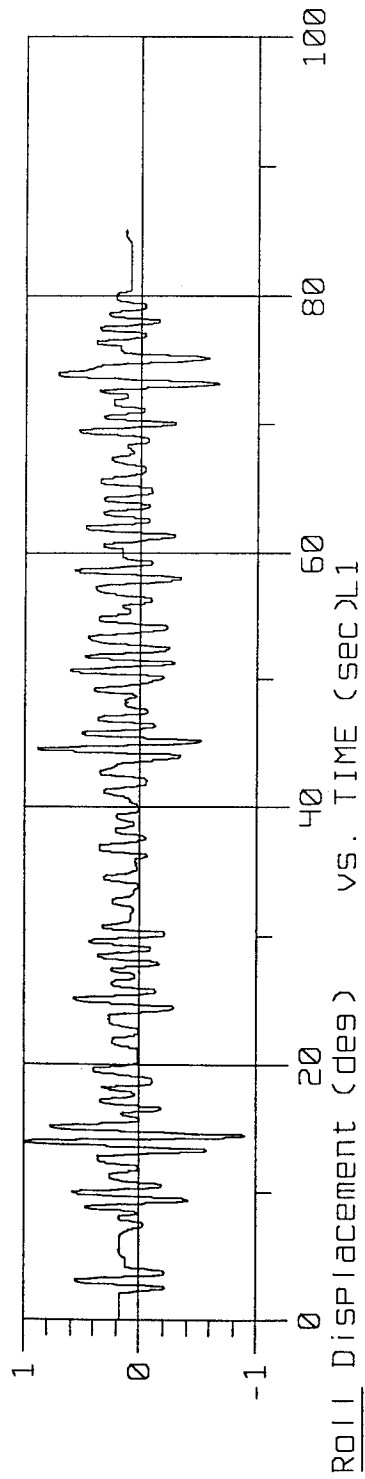
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Measured Data for Perryman1 @ 25mph



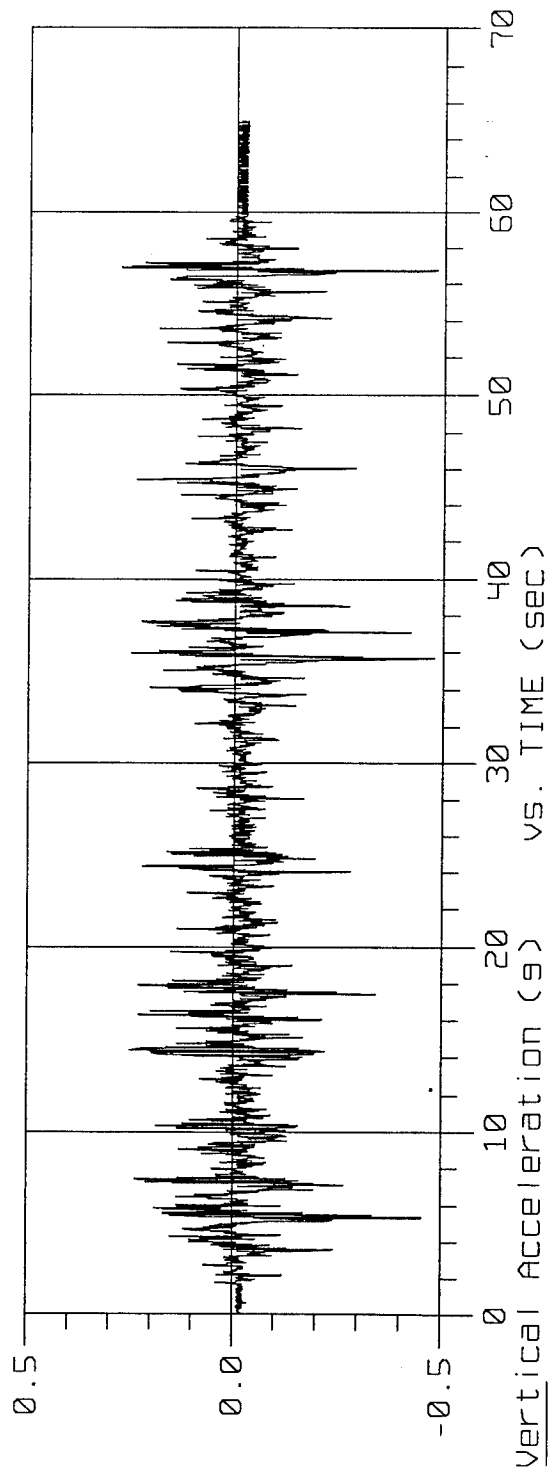
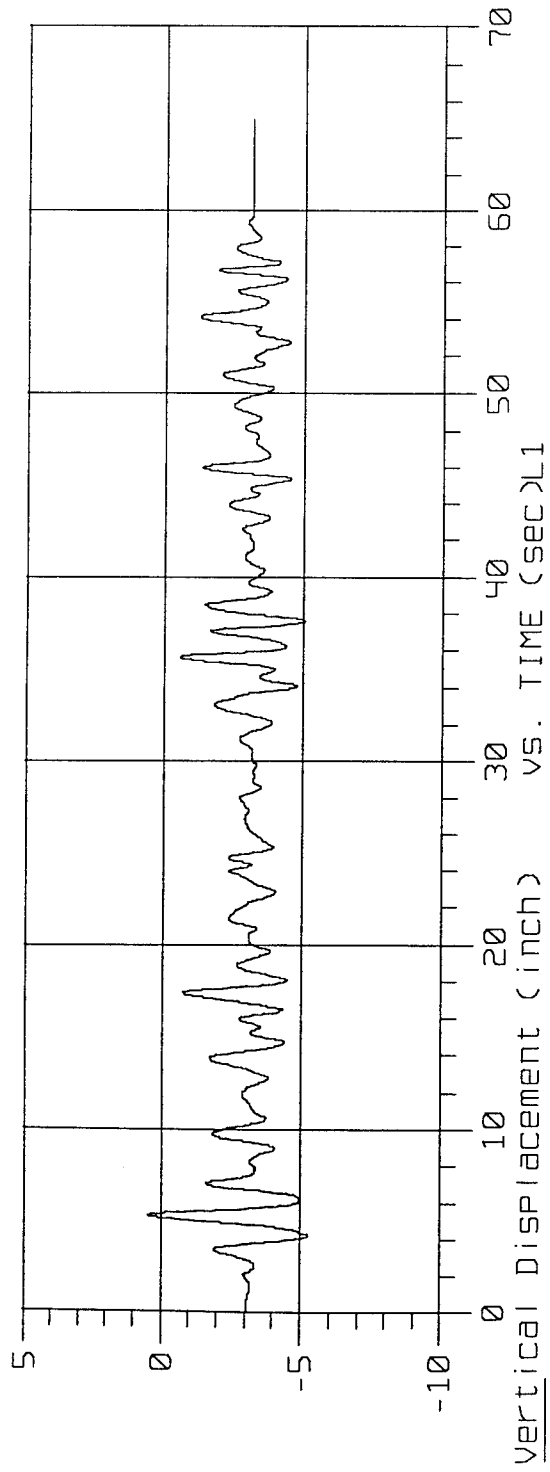
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Measured Data for Perryman1 @ 25mph



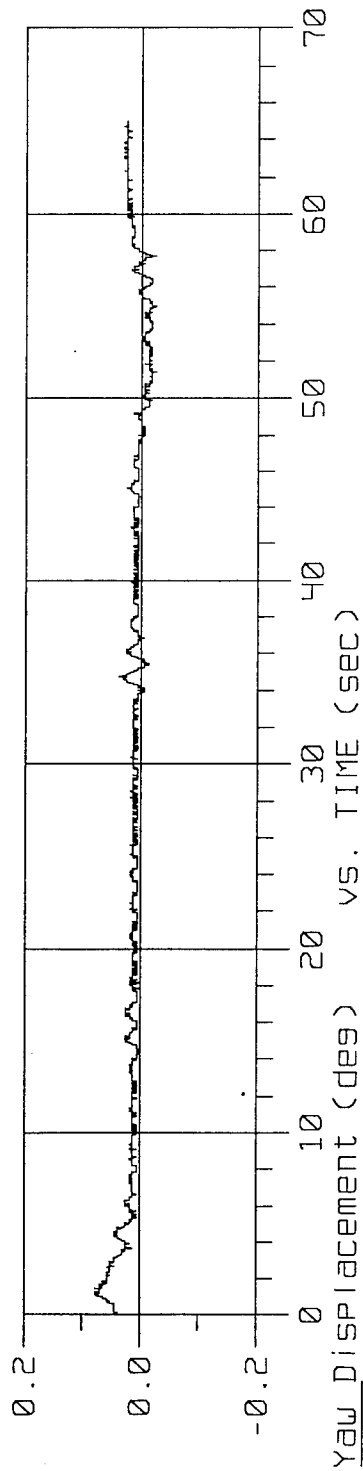
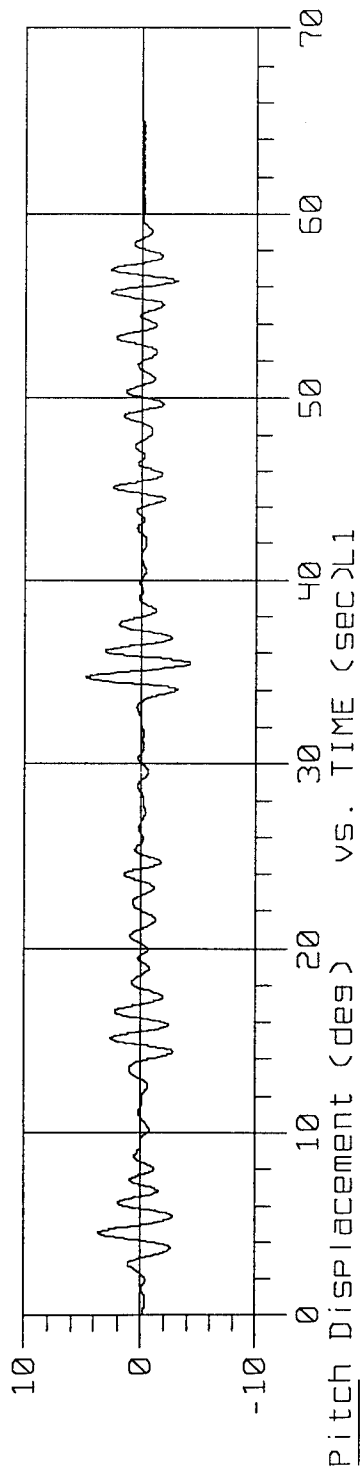
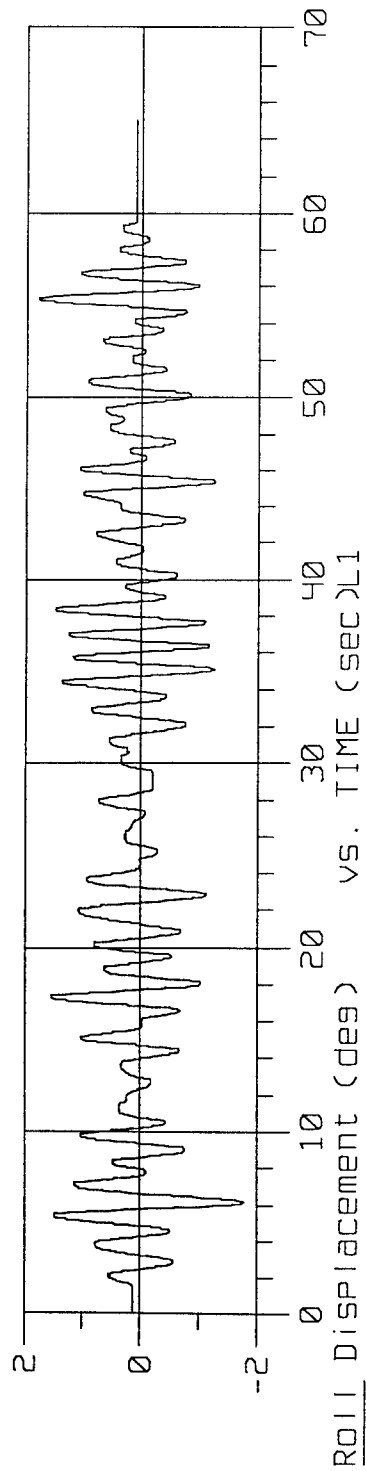
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Measured Data for Perryman2 @ 15mph



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Measured Data for Perryman2 @ 15mph



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